Bank Recapitalization in a DSGE Framework

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Views are personal and do not necessarily represent the views of RBI

Introduction and motivation

- Global financial crisis- G20 Nov 2008
- Accentuates ill effect of economic cycle,
- Financial Stability Board, IMF and BIS
- Bank act as a shock absorber between financial sector and real sector
  - Included in Basel III
  - Capital improvement in quality and quantity terms
- Design to absorb unexpected losses (capital)
- In CET1, the most subordinate claim in case of bank liquidation.
- Cost (GDP) and benefit (financial stability)

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Recapitalization – Cross Country

Country	First Announced	Maximum Amount	Instruments	Pricing of Instruments (key elements)
France	October 13, 2008	€ 40 billion	Preferred shares, subordinated debt, and common/ordinary shares for troubled banks	For subordinated debt: Fixed rate for first five years, variable rate thereafter
Germany	October 13, 2008	€ 80 billion	Any means appropriate	Market-compatible compensation
Italy	October 8, 2008	-	Preferred shares	-
Italy	November 28, 2008	-	Undated/perpetual subordinated debt/loan	The highest of three options, with fees increasing over time
Japan	December 17, 2008	¥ 12 trillion	Preferred shares	-
Japan	March 17, 2009	¥ 1 trillion	Subordinated debt, undated/perpetual subordinated debt/loan	Minimum spreads will be set by central bank at each auction
Netherlands	October 9, 2008	€ 20 billion	Any means appropriate	8.5 per cent coupon, subject to conditions related to dividend payments
Spain	October 13, 2008	-	Common/ordinary shares, preferred shares and/or non-voting shares	-
United Kingdom	October 8, 2008	£ 50 billion	Common/ordinary shares, preferred shares	For common/ordinary shares: 8.5 per cent discount to the closing price
United States	October 13, 2008	$ 250 billion	Preferred shares, warrants	Preferred shares: 5 per cent annual dividend for five years, 9 per cent thereafter
United States	February 10, 2009	-	Mandatory convertible preferred (MCP) shares (converts after 7 years), warrants	MCP shares: 9 per cent annual dividend, paid quarterly

Source: Fabio Panetta, Thomas Faeh, Giuseppe Grande, Corrinne Ho, Michael King, Aviram Levy, Federico M Signoretti, Marco Taboga and Andrea Zaghini (2009). "An Assessment of Financial Sector Rescue Programmes", BIS Papers No 48, July.

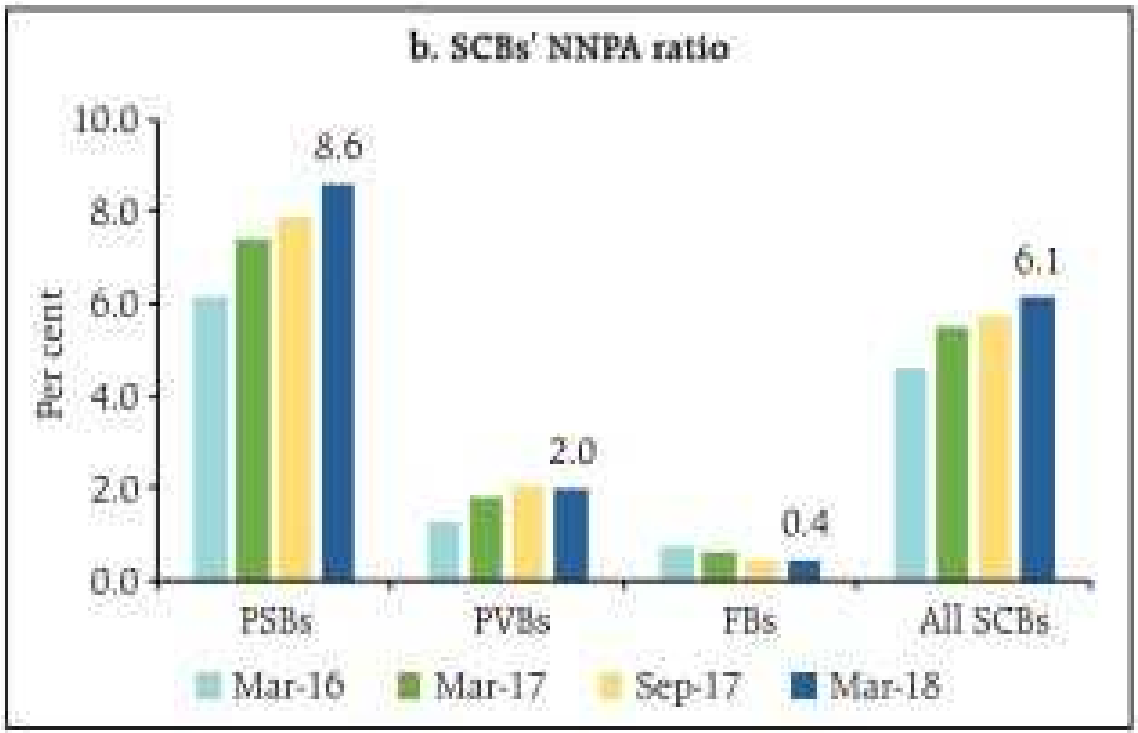
Recapitalization in India

- Capital infusion by promoters
- Market Borrowing-increase in cost
- Reducing –RWA
  - More Gsec investment with zero risk weight

Source: RTP, RBI

Recapitalization in India

- Bank dependence
- PSB dominated banking sector
- Large capital requirement and NPAs of PSBs
- Banks maintain SLR, LCR



Source: FSR, RBI

Major recapitalization drives in India

- January, 1994 –
  - Rs.57 billion through 10% Recap Bonds 2006
  - Transferable, eligible for obtaining loans from any other banks or FIs
  - Not eligible for SLR purposes
  - 2006-07 converted into tradable SLR eligible dated securities
- August 2015 – Indradhanush plan
  - Budget allocation Rs. 700 billion
  - Market borrowing Rs. 1.1 trillion

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Is this time different?

Is this time Different? – Recap Bonds Operations

- Press Releases on
  - October, 2017 and
  - January, 2018
- Possible Operation
  - Step I: Debit GoI Account – Credit PSBs – Equity from Bank to Govt.
  - Step II: Debit PSBs – Credit GoI – allocation of Recap bonds to PSBs (SGL A/c)
- Interest on newly issued security will be determined by the GoI

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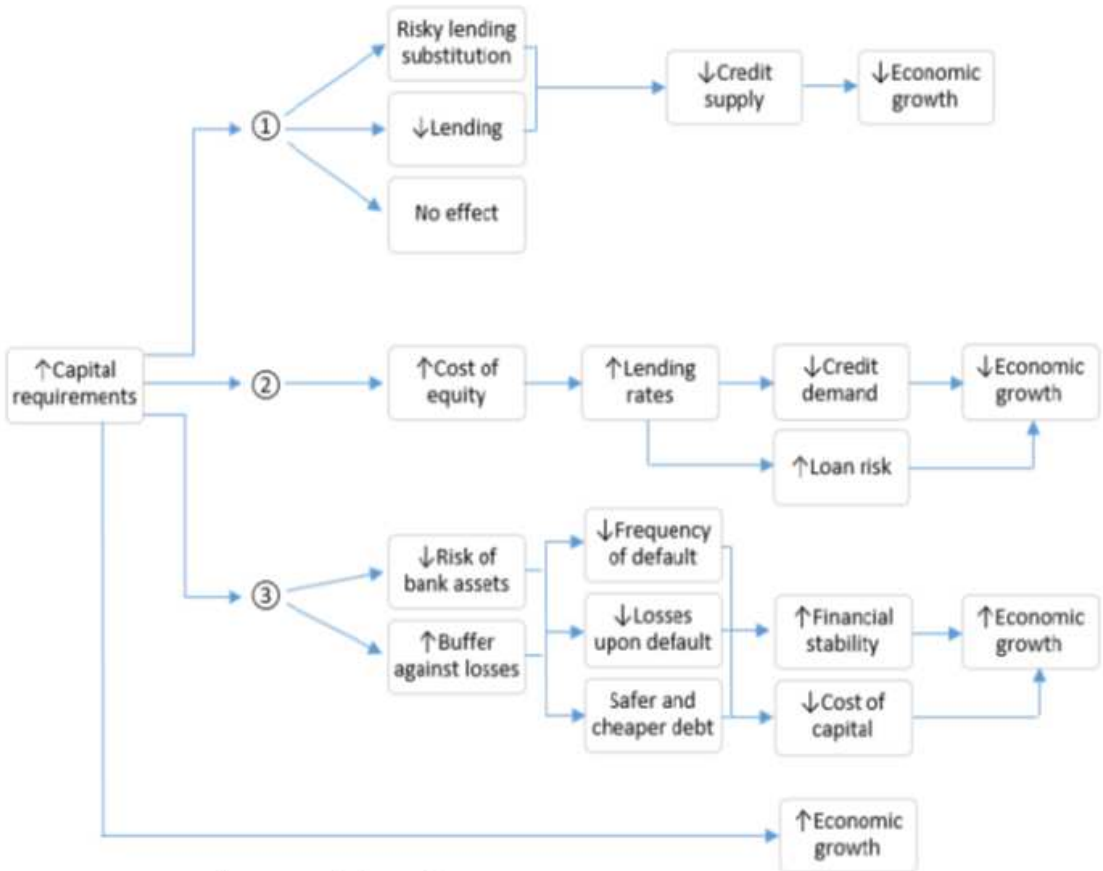
Capital infusion through other sources

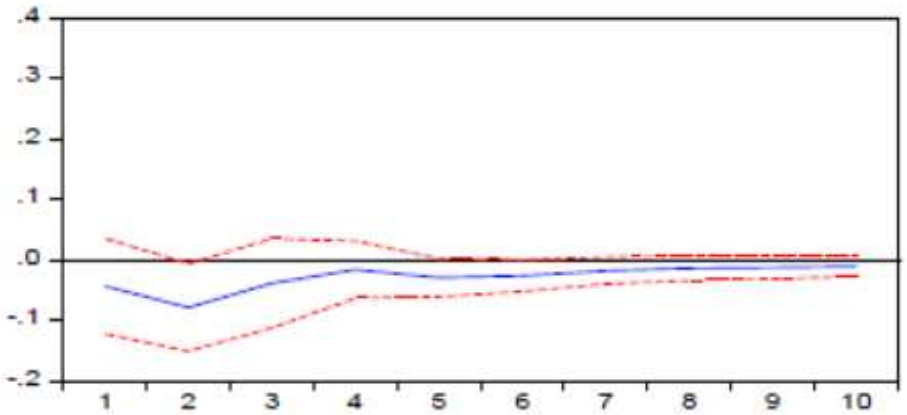
Impact of an increase in capital

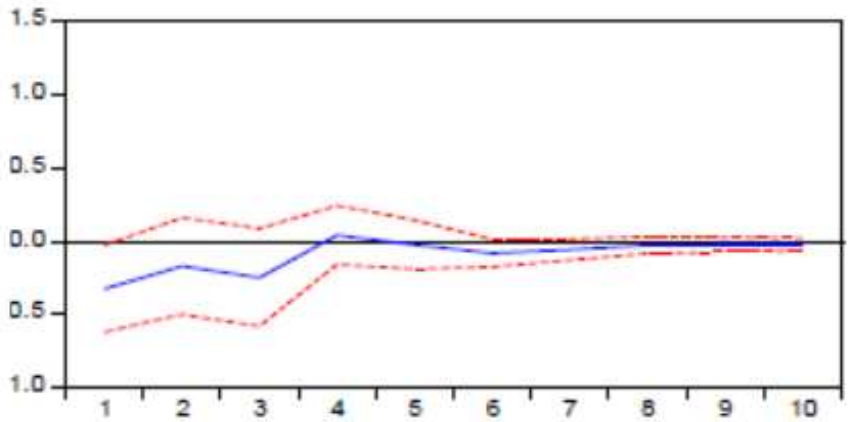


Source: http://www.dnb.nl/en/binaries/Working%20paper%20467_tcm47-319679.pdf.

Capital infusion through other sources

Response to Generalized one SD Innovation to (a) SCB credit (b) GDP growth (Q-O-Q)

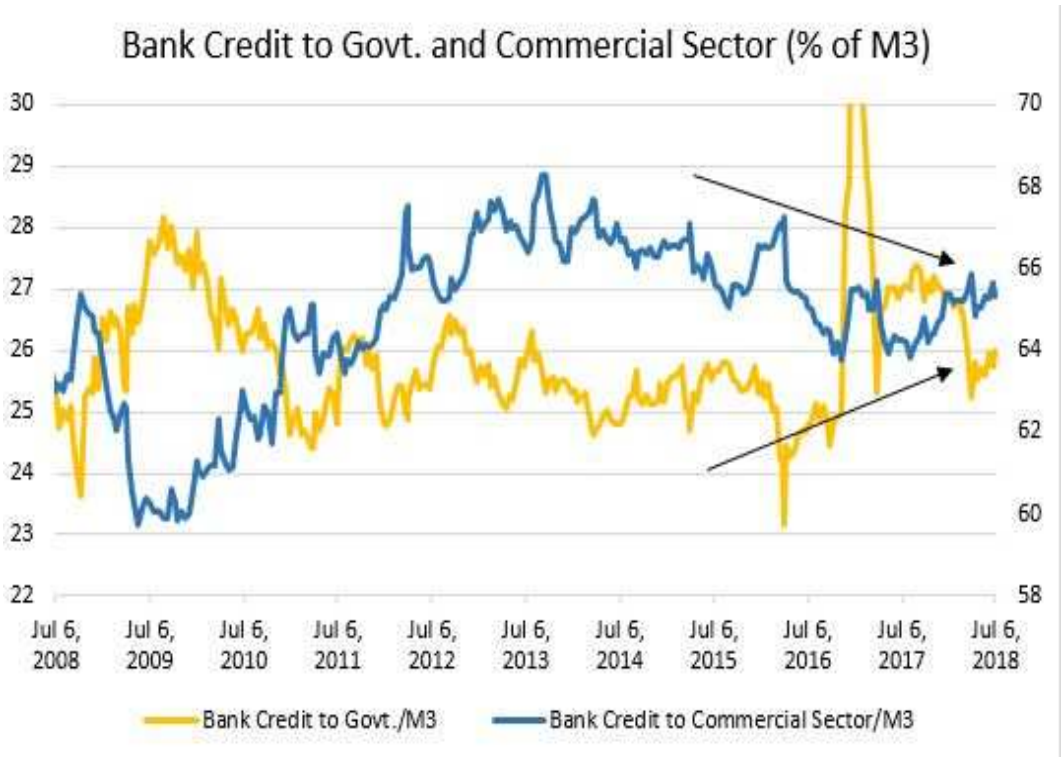




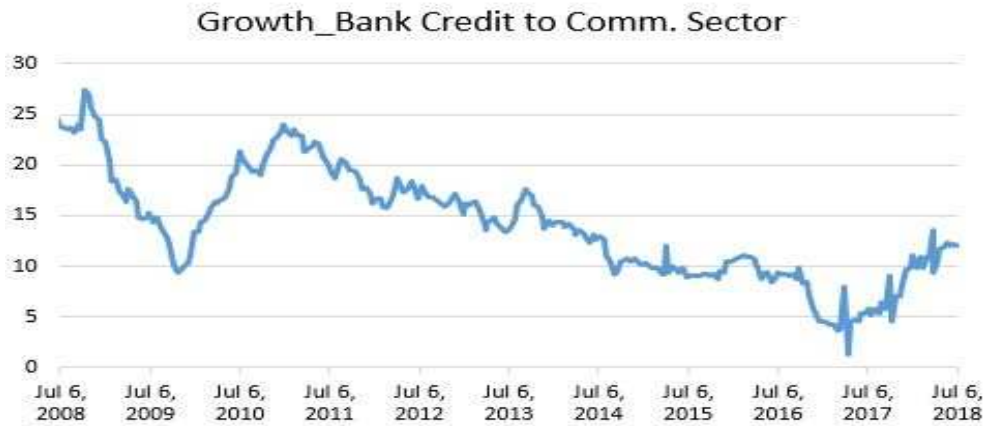
Ghosh (2015), IIBF

Banking B/S – a snapshot

Bank credit to government vs. commercial sector

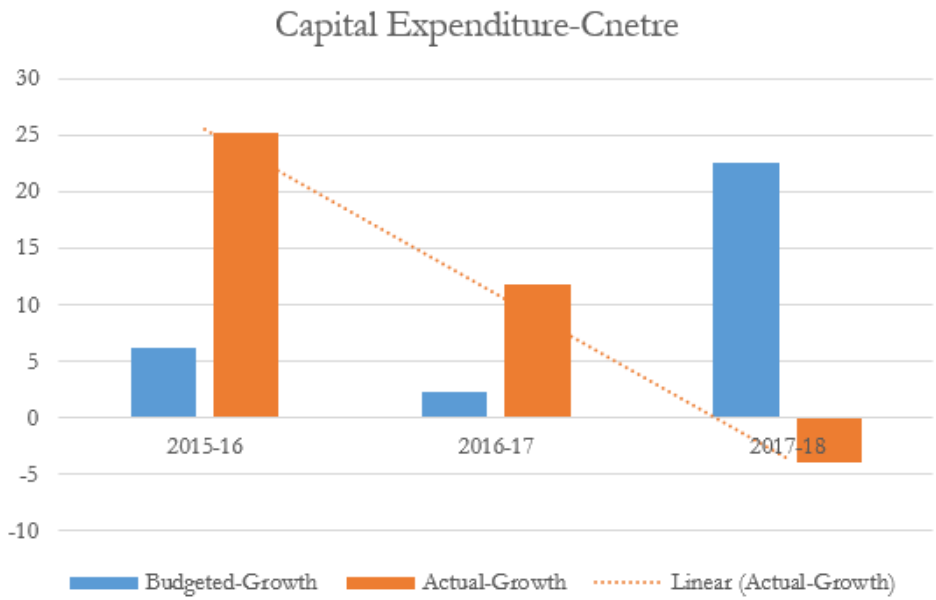


Growth and distribution of bank credit to commercial sector

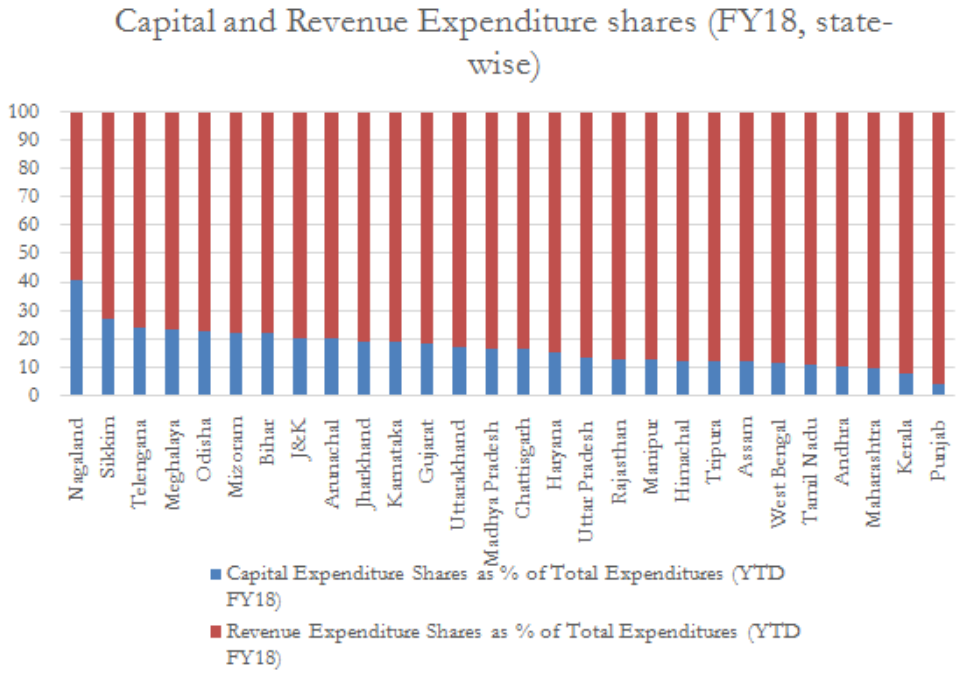


Source: FSR, RBI

Capex concerns!



Union Budget 2018-19 was the central government's capital spending, which was revised down sharply for FY18 – from budgeted growth of ~11% to a decline of ~4%



Key policy parameters and variables

Policy Parameters	Endogenous variables
Bank's holding of Government Bonds (Φ)	Labor (H)
Firms Default Probabilities (p)	Output (Y)
Government's equity holdings in Banks (e)	Capital (K)
Monitoring cost (γ, σ)	Bank Deposits (d)
	Consumption (C)
	Bank Lending Rates (R^L)

Model – Households

- Households derive utility from effective consumption (C_t^*) and leisure $(1 - H)$, where

$$C_t^* = C_t + \mu G_t^C, \qquad \mu > 0 \tag{1}$$

- Households also make a deposit in a state owned bank, and receive a share $(1 - e)$ portion of the bank's profit. Therefore, households

$$\max_{\{C_t, H_t, d_t\}} E_0 \sum_{t=0}^{\infty} \beta^t [\ln(C_t + \mu G_t^C) + \ln(1 - H_t)], \tag{2}$$

subject to,

$$(1 + \tau_C) C_t + d_t \leq (1 - \tau_W) W_t H_t + R_t^D d_{t-1} + (1 - e)\Pi_t^b \tag{3}$$

Model – Households

- First Order Conditions Yield

$$\frac{1}{C_t^*} = \beta E_t \left[\frac{R_{t+1}^D}{C_{t+1}^*} \right] \tag{4}$$

$$\left(\frac{C_t^*}{W_t} \right) \left(\frac{1+\tau_C}{1-\tau_W} \right) = 1 - H_t \tag{5}$$

- In the steady state,

$$R^D = \frac{1}{\beta}$$

$$\left(\frac{C^*}{W} \right) \left(\frac{1+\tau_C}{1-\tau_W} \right) = 1 - H$$

Model – Final Good Firm

- The firm produces output using labour and capital,

$$Y_t = A_t K_{t-1}^{\alpha} (G_t^P H_t)^{1-\alpha} \tag{6}$$

- The firm borrows $L_t = Q_t K_t$ from the bank and repays with probability $(1 - p_t^*)$.
- p_t^* is assumed to be contingent on the realization of the TFP

$$p_t^* = p^*(A - A_t) \tag{7}$$

- The firm seeks to maximize it's profits given by,

$$\max_{\{K_t, H_t\}} E_0 \sum_{t=0}^{\infty} \Omega_{t,t+s} [Y_t - W_t H_t - Q_t K_t + \tag{8}$$
$$(1 - \delta_K) Q_t K_{t-1} + L_t - (1 - p_t^*) R_t^L L_{t-1}],$$

where

$$G_t^P \sim CSSP. \tag{9}$$

$$\Omega_{t,t+s} = \frac{\beta^s U'(C_{t+s})}{U'(C_t)} \tag{10}$$

Model – Final Good Firm

- The first order conditions w.r.t. K_t and H_t are as follows:

$$\{K_t\} \quad : \quad E_t\left[\alpha\frac{Y_{t+1}}{K_t} + (1-\delta_k)\,Q_{t+1} - (1-p^*_{t+1})\,R^L_{t+1}\,Q_t\right] = 0 \tag{11}$$

$$\{H_t\} \quad : \quad E_t\left[(1-\alpha)\,\frac{Y_t}{H_t} - W_t\right] = 0 \tag{12}$$

- In the steady state,

$$K = \left[\frac{A\alpha}{Q[(1-p)R^L - (1-\delta_k)]}\right]^{\frac{1}{1-\alpha}} G^P H \tag{13}$$

$$H = \left[\frac{(1-\alpha)A\left(G^P\right)^{1-\alpha}}{w}\right]^{\frac{1}{\alpha}} K \tag{14}$$

Model – Capital Good Firm

- Capital goods firm produces new capital, using the undepreciated capital and I_t units of final good from final good producing firm at a price Q_t.
- This is sold to the final goods firm. The profit maximization is given by

$$\max_{\{K_t\}} E_0 \sum_{t=0}^{\infty} \Omega_{t,t+s} \left[Q_t \left[K_t - (1-\delta_K) K_{t-1} \right] - I_t \right] \tag{15}$$

subject to

$$I_t = K_t - (1-\delta_K) K_{t-1} + K_{t-1} S\left(\frac{K_t}{K_{t-1}} \right) \tag{16}$$

and,

$$S\left(\frac{K_t}{K_{t-1}} \right) = \frac{\kappa}{2} \left(\frac{K_t}{K_{t-1}} - 1 \right)^2 \tag{17}$$

- In the Steady State

$$Q = 1 \tag{18}$$

Model – the banking sector

- Banks are state owned. A portion of the profits in every time period goes to the government, and the rest goes to households.
- The bank receives deposits from the household, a fraction Φ of which is held as government bonds. The remaining proportion $(1 - \Phi)$ is used for lending activity. .
- The bank also incurres a monitoring cost to reduce the default risk, and receives a transfer from the government for the loss due to non-repayment by firms

Model – the banking sector

- The objective is to maximize the discounted lifetime profits:

$$\begin{aligned}\Pi_t^b &= E_0 \sum_{t=0}^{\infty} \Omega_{t,t+s}\big[d_t - R_t^D d_{t-1} - L_t + (1-p) R_t^L L_{t-1} \\ &\quad -\Phi d_t + R_t^G \Phi d_{t-1} - \gamma(L_t) + p R_t^L L_{t-1}\big]\end{aligned} \tag{19}$$

where,

$$\begin{aligned}L_t &= (1-\Phi) d_t \\ \gamma(L_t) &= \gamma L_t^{\sigma}.\end{aligned}$$

- In the steady state, for $\sigma = 1$,

$$R^L = \frac{1 - \beta\Phi R^G + \gamma(1-\Phi)}{(1-\Phi)\beta} \tag{20}$$

Model – Government

- The government budget constraint is given by,

$$G_t^P + G_t^C = \tau_C C_t + \tau_W W_t H_t - \Phi R_t^G d_{t-1} + \Phi d_t + e\Pi_t^b - pR_t^L L_{t-1}$$

- A richer version could include costs associated with deviations from a targeted debt level or interest rate spreads

Numerical simulations – Parameters

Parameters	Values	Source
α	0.35	Ghate et al. (2016)
β	0.98	Literature
γ	> 1	Authors
σ	$\geqslant 1$	Authors
τ_c	0.12	Ghate et al. (2016)
κ	0.0001	Ghate et al. (2017)
τ_w	0.01	Poisron (2001)
μ	< 1	Roche (1996)
δ_k	0.1	Data
R^G	1.02	Data
Φ	0.2	Data
e, p	< 1	Varied
G^P, A	Exogenous	Authors

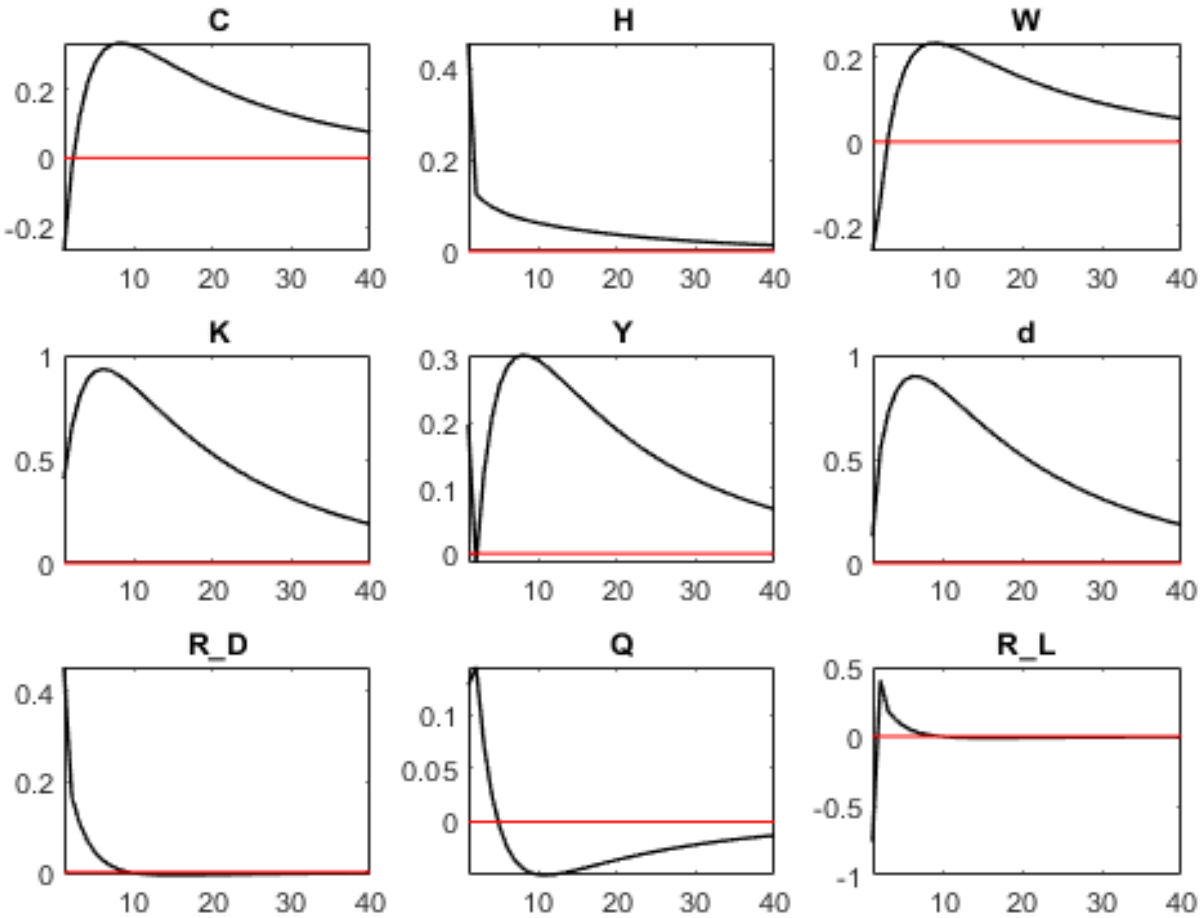
Impulse Response Functions

- We analyse the impact of a one period shock to productivity that affects the probability of default, p_t^*

$$p_t^* = p^* \exp\left(A - \widehat{A}_t\right), \text{ where } \widehat{A}_t \sim N\left(0, \sigma_A^2\right)$$

- If $A_t \leq A$, $p_t^* \geq p^*$ i.e., the probability of default increases in comparison to the steady state

Impulse Response Functions – unconditional transfers



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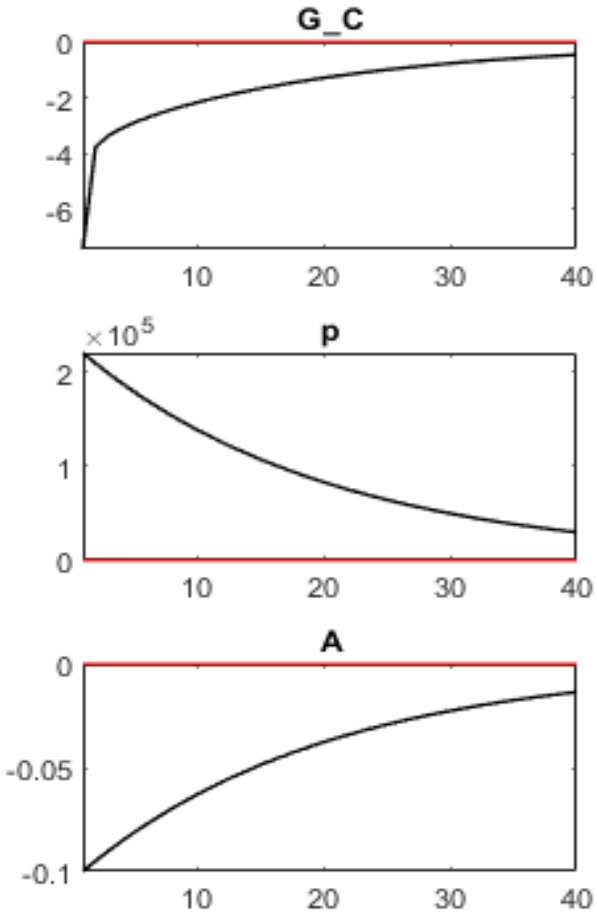
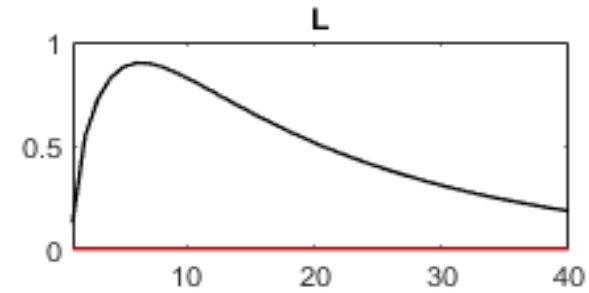
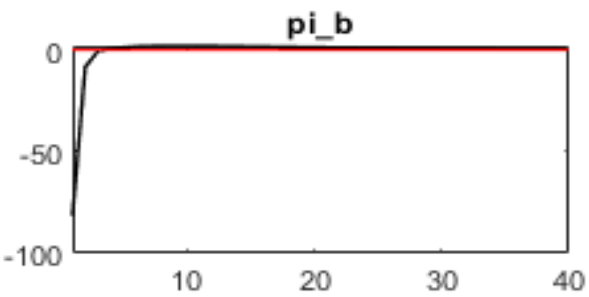
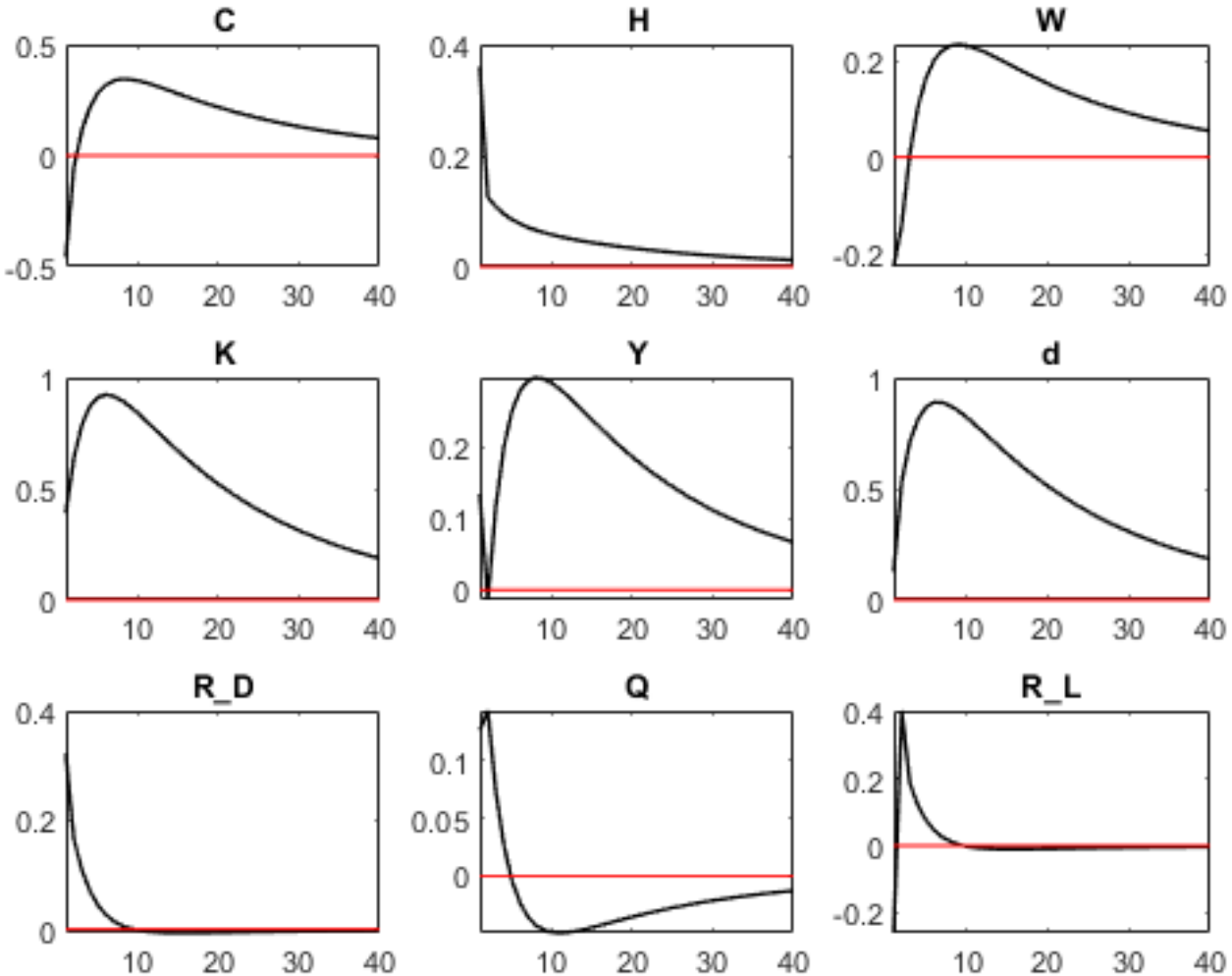




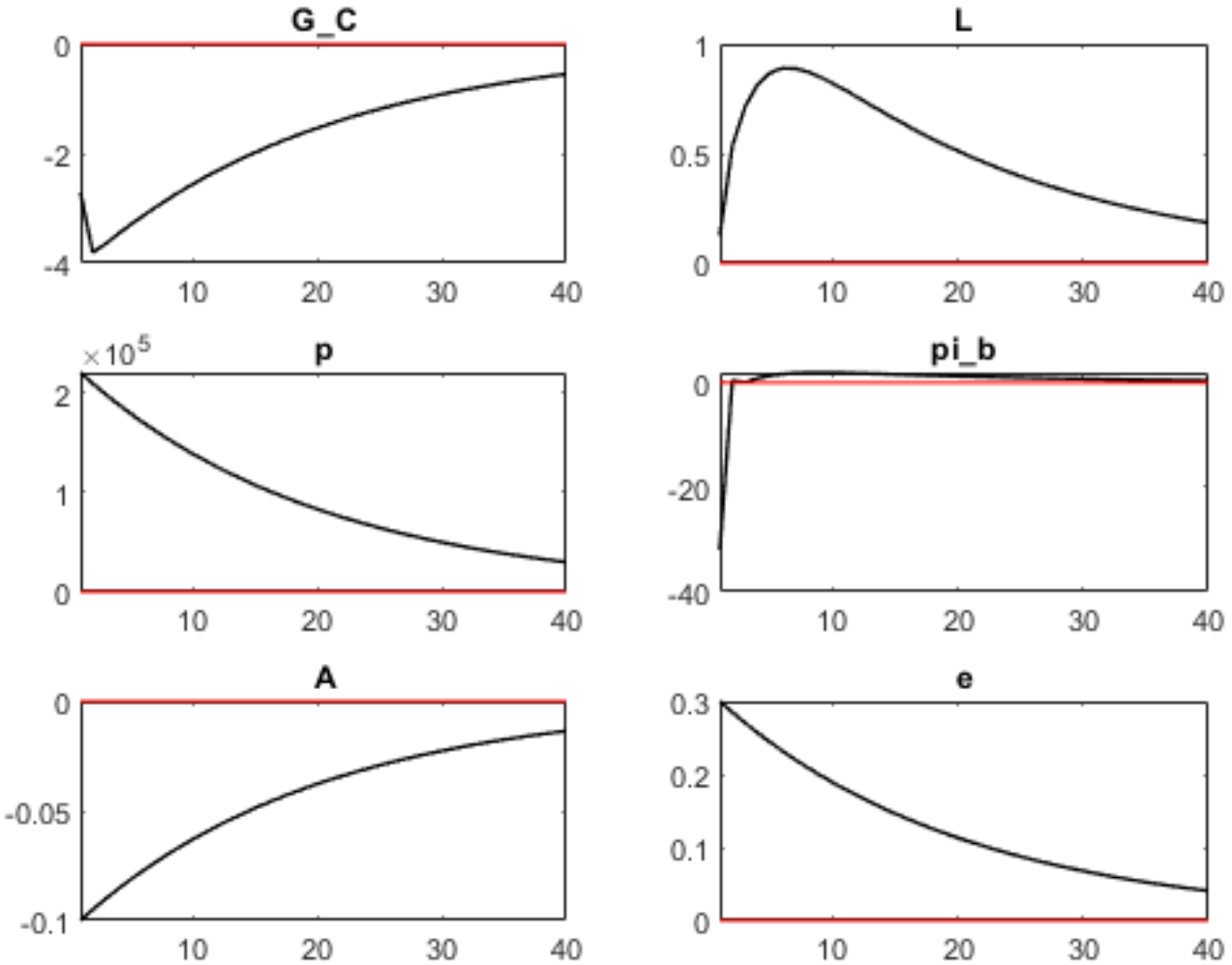


Impulse Response Functions – ctransfers

$e = \underline{e} + \varpi.\overline{p},\ \varpi > 0$



Impulse Response Functions – conditional transfers



Conclusion and future course of action

- We simulate a structural model including some of the unobserved parameters such as default probabilities of borrowers and surveillance cost to evaluate the impact of bank capitalization.
- Our baseline result shows, bank recapitalization enhances capital formation and output. However, with higher default probabilities, it could be welfare reducing.
- Results indicate conditional transfer could be a better way of bringing discipline into a public recapitalization program as compared to unconditional transfer.
- Recapitalization and capital adequacy, in the absence of moral hazard, could positively affect capital formation and growth.
- Furthermore, while welcoming bank recapitalization, we also call for appropriate policy vigil to protect the quality of public expenditure in the social sector.

Thank you